General biology of rusts.—Of more than ordinary biological interest is a paper by TISCHLER[3] on the relation between *Uromyces Pisi* and its aecidial host, *Euphorbia Cyparissias*. As is well known, the infection of *E. Cyparissias* by that rust takes place in the buds of the subterranean shoots in which the mycelium persists during the winter. The shoots which arise from such infected buds in the following spring show the characteristic deformations caused by the rust, but occasionally shoots are observed which outgrow the disease and develop normal leaves on their upper portion. This behavior led TISCHLER to investigate at what stage in their transition from embryonic to mature tissue the cells are subject to the formative influence of the fungus, and also to what extent such influence reaches beyond the area actually invaded by the mycelium. He found that the growing points of infected plants could be freed from the fungus by keeping the plants at a high temperature or under other conditions favoring rapid development. Under such conditions the newly developed parts of the shoots are normal. The emancipation of the growing apex from the fungus succeeds more readily as the fungus approaches the fruiting stage, and after the aecidia are mature normal branches frequently develop from the infected plants if they retain sufficient vitality. Conversely, when the formation of aecidia is suppressed (by keeping the plants in the dark), it is not possible to free the shoots from the fungus. The fungus appears to be incapable of further development after it has reached the fruiting stage.

These experiments show that the meristematic tissue of the growing point is not subject to the formative influence of the fungus, but that such influence must be exerted on cells which are no longer embryonic; nevertheless a histological examination shows that the mycelium is present even among the outer layers of embryonic cells. Here, however, the mycelium is entirely intercellular, no haustoria being formed. As soon as the cells lose their strictly embryonic character, that is, as soon as vacuoles appear in them, haustoria begin to develop from the mycelium in their intercellular spaces. The formative influence of the fungus, therefore, appears to be coincident with the formation of haustoria. The development of haustoria the author associates with the formation of soluble carbohydrates whose presence can be shown in the older but not in the embryonic cells. The presence of hyphae among the embryonic cells shows that the growing point is not protected from invasion by substances toxic to the fungus.

Regarding the general development of the fungus, the author finds that in the rapidly growing shoots the hyphae advance in the tracheae, by means of which the fungus is enabled to keep pace with the growth of the plant. From the tracheae the infecting hyphae enter the parenchymatous tissue of the cortex, pith, and leaves. The cambium, like the embryonic cells of the growing point, is not infected. The formative influence of the mycelium on

[3] TISCHLER, G., Untersuchungen über die Beeinflussung der *Euphorbia Cyparissias* durch *Uromyces Pisi*. Flora **104**:1–64. *figs. 26*. 1911.

the stems is slight, but in the leaves the cells undergo more active divisions than those of normal leaves, and the intercellular system is more developed. These changes seem to be characteristic of the fungus, but most of the other morphological changes associated with it can also be induced by other conditions. Both in the stem and in the leaves the localization of the mycelium is dependent upon the presence of soluble carbohydrates in the tissues.

In the later stages of development of the plant, processes of disorganization begin. The death of the leaf cells is accompanied by processes characteristic of cells which are being slowly poisoned. Of the parts of the fungus the haustoria are the most persistent. In the rhizomes they become greatly developed and form a sort of pseudo-parenchymatous tissue in the cells, but they are not the sources of infection in the following year.

Of interest in connection with a consideration of the relations between parasitic fungi and their hosts are the experiments of MORGENTHALER[4] showing that the production of teleutospores is determined more by the state or condition of the host than by the influence of external factors. The author investigated the factors influencing the production of teleutospores of *Uromyces Veratri* on *Veratrum album*. He found that cutting the veins of leaves or wounding the leaves in other ways led to a production of teleutospores in the neighborhood of the wounded tissue, while in the other areas of the leaf uredospores predominated. In general, any cause that affects the leaf unfavorably leads to the production of teleutospores. In standing plants teleutospores are first formed on the lower leaves because these lose their vitality first; but if the plants are cut and kept in water, the upper leaves wilt and become discolored first. In that case teleutospores appear on the upper leaves first, even if all have been inoculated at the same time. From a number of such experiments the author concludes that the production of teleutospores is determined by the changes leading to the withering or dying of the infected parts of the host plants. This conclusion is further strengthened by a number of observations on the distribution of uredospores and teleutospores in relation to the state of the infected parts of the host in herbarium material.

KUSANO[5] gives an account of chloranthic deformation of the flowers of *Prunus Mume* caused by the mycelium of *Caeoma Makinoi*. As a result of the action of the mycelium of this fungus on the primordia of the floral parts, the course of their development is changed so that leaflike structures are produced in place of floral organs. The degree of transformation differs in different flowers. In extreme cases the cuplike receptacle bears a tuft of well developed leaves which in no way resemble floral organs. In other cases leaves take the place of only one or more of the whorls of floral organs, or some of the

[4] MORGENTHALER, O., Über die Bedingungen der Teleutosporenbildung bei den Uredineen. Centralbl. Bakt. II. **27**:73–92. *figs. 18.* 1910.

[5] KUSANO, S., On the chloranthy of *Prunus Mume* caused by *Caeoma Makinoi*. Jour. Coll. Agric. **2**:287–326. *pls. 17, 18.* 1911.

organs are only partly modified. The many resulting types are described in detail by the author. The degree of transformation is correlated with the state of development of the primordia at the time that they are infected. The influence of the fungus evidently does not extend beyond the tissue actually invaded. These conclusions, however, are drawn from observations of the visible transformations. No histological details, which would be exceedingly interesting in this case, are reported.

DIETEL[6] has published a second instalment of his studies on the factors influencing the germination of teleutospores. Among the results reported the following are of interest. The teleutospores of *Melampsora Larici-Tremulae* Kleb. are capable of germinating in March and later. Their germination takes place readily at temperatures between 8° C. and 26° C. In the study of *Puccinia graminis* Pers., it was found that the abnormal mode of germination, sometimes observed in teleutospores of this species, is determined by the temperature. At temperatures below 23° C. normal germination takes place, but at higher temperatures the teleutospores simply produce long germ tubes which occasionally become segmented. A similar mode of germination of the teleutospores of *P. Malvacearum* has been observed by TAUBENHAUS[7] and also by ERICKSSON,[7] who attributes to the "conidia" abjointed by the segmentation of the germ tube a special function in the biology of this rust. DIETEL finds, however, that in *P. Malvacearum* the formation of sporidia, or of germ tubes which segment into "conidia," is determined by the conditions under which germination takes place and not by functional differentiation of the spores. High temperature and lack of moisture favor the production of abnormal germ tubes.

To the few observations which have been made on the transmission, from the stock to the scion, and inversely, of grafted plants, of qualities producing immunity from the attack of fungi to which one or the other is subject, FISCHER[8] adds a further observation supporting the general conclusion that no such mutual influence between the stock and the scion exists. He finds that plants of *Mespilus*, which cannot be infected by the basidiospores of *Gymnosporangium confusum*, remain immune even when united by grafting with susceptible species of *Crataegus*, nor is the susceptibility of the *Crataegus* changed.

A special case is presented by *Crataegomespilus Asnieresii*, which is a chimaera consisting of a *Crataegus* core with a *Mespilus* epidermis. Here FISCHER found that the germ tubes of the basidiospores penetrated the epidermis and infected the *Crataegus* tissue underneath. He reserves his opinion, however, as to any mutual influence of the two parts of the plants, stating

---

[6] DIETEL, P., Versuche über die Keimungsbedingungen der Teleutosporen einiger Uredineen. II. Centralbl. Bakt. II. **35**:272–285. 1912.

[7] Rev. in BOT. GAZ. **54**:431–433. 1912.

[8] FISCHER, ED., Beiträge zur Biologie der Uredineen. Mycol. Centralbl. **1**:195–198. 1912.

that it is not certain that the species of *Mespilus* entering into the foregoing chimaera is immune, and even if it were, the result of the experiment does not imply that the *Mespilus* epidermis had become susceptible, since it is known that germ tubes of fungi frequently penetrate inert membranes and even the epidermis of plants in whose tissues they are unable to make any further growth.

ORTON[9] describes a number of cases of correlation in the distribution of certain heteroecious species of *Puccinia* and *Uromyces*. The forms thus correlated have for their telial hosts the same species or closely related species of the same genus, while their aecidia occur on alternate hosts which are either identical or which are species of one genus. The aecidia and the uredospores of the associated rusts are similar in structure, form, and color, while the teleutospores differ only in number of cells. As examples may be cited *Puccinia subnitens* and *Uromyces Peckeanus*, both of which occur on *Distichlis spicata* and have aecidia similar in their essential characteristics on species of the Chenopodiaceae; also *Puccinia Caricis-Asteris* and *Uromyces perigynius* with teleutospores on species of *Carex* and aecidia on members of the Compositae. This condition appears to point to a close relationship between the two genera *Puccinia* and *Uromyces*.

In opposition to the view that rust-infected grains of cereals are the agencies by which the grain rusts are carried over from year to year, ERIKSSON[10] points out that grains bearing rust pustules are, both in his own experiments and according to statements in the literature, of very rare occurrence; and that plants developing from such grains do not become infected earlier nor more severely than plants from normal seeds. Furthermore, a cytological study of a large number of plants from plots which afterward were badly rusted failed to show the presence of mycelium by means of which the rust might have lived through the winter. He concludes, therefore, that the rust pustules on infected seed grain are of no significance in connection with the rust of the grain crop.—H. HASSELBRING.

Chloroplasts and chlorophyll.—LIEBALDT'S work[11] on chloroplasts emphasizes again the important part colloidal chemistry is coming to play in physiological problems. The chloroplast is considered a two-phase disperse system. The pigments, especially the green ones, constitute the lipoid phase, and the stroma, insoluble in lipoid solvents, coagulable with heat and alcohol, and swelling in water, is the hydroid phase. The lipoid phase shows amicronic (in particles beyond the vision of the ultramicroscope) dispersal through the

---

[9] ORTON, C. R., Correlation between certain species of *Puccinia* and *Uromyces*. Mycologia **4**:194–204. *pls. 2*. 1912.

[10] ERIKSSON, J., Rostige Getreidekörner- und die Überwinterung der Pilzspecies. Centralbl. Bakt. II. **32**:453–459. 1912.

[11] LIEBALDT, ERNA, Über die Wirkung wässeriger Lösung oberflächenaktiver Subitanzen auf die Chlorophyllkörner. Zeitsch. Bot. **5**:65–113. 1913.